

21 March 1956

## MILITARY SPECIFICATION

DRIVE, ANTENNA, VERTICAL STABILIZATION, FOR AS-473/ASB-1  
(BuOrd Drawings 776405, 776463, Vertical Stabilization  
Servo Clutch, for ASB-1; 864390, 1444082 for ASB-1A)

### 1. SCOPE

1.1 This specification covers the equipment, material, and performance requirements to be used in the manufacture of a Vertical Stabilization Antenna Drive for use in a radar scanning antenna. One type and one grade only is specified.

### 2. APPLICABLE SPECIFICATIONS, STANDARDS, DRAWINGS, AND PUBLICATIONS

2.1 The following specifications, standards, drawings, and publications of the issue in effect on date of invitation for bids form a part of this specification.

#### 2.1.1 Specifications

Military

MIL-P-116      Preservation, Methods of

#### 2.1.2 Standards

Military

MIL-STD-129      Military Standard Marking  
of Shipments

### 2.1.3 Drawings

Bureau of Ordnance, Department of the Navy

List of Drawings, LD 272221, Vertical Stabilization Servo and all drawings and specifications listed thereon.

### 2.1.4 Publications

Bureau of Ordnance, Department of the Navy

NAVORD OP 400	Manufacture and Inspection of Ordnance Material, General Specification for
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NAVORD OD 8176	Paragraphs applicable to this equipment
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(Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the Procuring Agency or as directed by the Contracting Officer)

### 2.1.5 Other Publications

National Bureau of Standards Publications

Handbook H28	Screw-Thread Standards for Federal Services
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(Copies of H28 may be obtained upon application, accompanied by money order, coupon, or cash to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.)

## 3. REQUIREMENTS

3.1 Type Tests - Type tests as specified in Section 4 of this specification shall be made on representative samples of production assemblies.

3.2 General - Equipment furnished under this specification shall meet applicable requirements as listed in NAVORD OD 8176. In cases of conflict this specification shall apply.

3.3 Material - Materials shall conform to applicable specifications as specified herein and on the drawings. When materials are used which are not specifically designated, they shall be of the best commercial quality and entirely suitable for the purpose.

3.4 Design and Construction - The assembly shall conform to and be approved in accordance with this specification and applicable specifications, standards, and publications.

3.5 Interchangeability - Interchangeability shall be insured by conformance with dimensional limitations set forth on outline drawing, BuOrd number 776764.

3.6 Nameplates - A nameplate, permanently and legibly marked and made in accordance with BuOrd drawing 776416, shall be attached to each assembly.

### 3.7 Performance

3.7.1 Definitions - The following definitions are given for the purpose of instruction contained in this specification. Refer to BuOrd drawing 790458.

3.7.1.1 Coils A and B - Coil K502A shall be known as Coil A. Coil K502B shall be known as Coil B.

3.7.1.2 Current Difference - Current difference is defined as the difference between the current in Coil B and that in Coil A when one current has been raised by the same amount that the other has been lowered from a quiescent operating point of 10.0 ma.

3.7.1.2.1 Polarity - Current difference is positive when the current in Coil B exceeds the current in Coil A.

3.7.1.3 Cycle - A cycle is defined as the sequence of starting at zero current difference, raising the difference positively to 8 ma DC, reducing it to zero, going negatively to -8 ma DC, and then returning to zero.

3.7.2 Synchro Alignment - When the slot in the output coupling is vertical, as shown on BuOrd drawing 776405, and pointer, BuOrd drawing 838300, is aligned with scribe mark on gear, BuOrd drawing 838912, the synchro control transformer shall be at electrical zero within 0.05 volt. See NAVORD OD 7672 for synchro alignment procedure.

3.7.3 Backlash - The total play between the output coupling, BuOrd drawing 837015, and the clutch disc gears, BuOrd drawing 836963, shall not exceed a mean angular backlash of  $0.85^{\circ}$  as measured at the output coupling.

3.7.3.1 To determine the mean angular backlash, measure the backlash at four (4) positions of the output coupling, approximately  $90^{\circ}$  apart, and average. Care shall be taken to apply only enough force to take up the backlash. Any additional force will slip the clutch.

3.7.4 Output Torque - When a current difference of 8.0 ma DC is applied to the Vertical Stabilization Servo, the minimum output torque shall be 6.0 inch pounds.

CAUTION: In no case shall more than a 7 inch-pound torque load be applied to the output shaft of the Vertical Stabilization Servo unit.

### 3.7.5 Clutch Characteristics

3.7.5.1 The current difference values found at the 0.8 full speed point and the 0.2 full speed point shall differ by not less than 0.5 ma DC. This requirement shall hold on both positive and negative sides of the characteristic.

3.7.5.2 The current difference required for 0.8 full speed shall not exceed 7.0 ma DC. This requirement shall hold on both positive and negative sides of the characteristic.

3.7.5.3 The current difference value required for 0.8 full speed on the two sides of the characteristic shall not differ by more than 1.0 ma DC.

3.7.5.4 When the speed is decreasing and zero current difference is reached, the motion of the output shaft shall not exceed 0.02 of full speed.

### 3.8 Environmental Conditions

3.8.1 Temperature - The equipment shall conform with all requirements of this specification under temperature

conditions as specified in NAVORD OD 8176 except that the temperature range shall be modified to read  $-55^{\circ}\text{C}$  to  $+71^{\circ}\text{C}$  ( $-67^{\circ}\text{F}$  to  $+160^{\circ}\text{F}$ ).

3.8.1.1 To determine compliance with 3.8.1, each type test sample shall be subjected to one (1) cycle of inspection tests at maximum and minimum temperatures.

3.8.2 Humidity - The equipment shall conform with all requirements of this specification under humidity conditions as specified in OD 8176.

3.8.2.1 To determine compliance with 3.8.2, each type test sample shall be subjected to one (1) cycle of inspection tests at combinations of temperature and humidity that will alternately form water and frost on the unit.

3.8.3 Vibration - The equipment shall be subjected to vibration conditions as specified in OD 8176 except that the total excursion shall not exceed 0.031 inch. See BuOrd drawing 776764 for normal mounting.

3.8.4 Shock - The equipment shall not suffer damage or subsequently fail to provide the performance specified herein when it is mounted as normally used and is subjected to six (6) impact shocks of 10g's, each shock impulse having a time duration of  $11 \pm 1$  milliseconds. See BuOrd drawing 776764 for normal mounting. Two (2) shocks shall be applied in each of the three (3) principal axes, one (1) shock in each direction.

3.9 Lubrication - Lubrication shall be as specified on drawings.

3.10 Workmanship - Workmanship shall be in accordance with the best instrument practice. Particular attention shall be given to machined surfaces to insure conformance with drawing limitations and insure against superficial defects. Attention shall also be given to painted areas to insure clean and scratch-free surfaces.

#### 4. SAMPLING, INSPECTION, AND TEST PROCEDURE

##### 4.1 General Instructions

4.1.1 Responsibility for Tests - The Contractor shall furnish all samples, if required, and shall be responsible for accomplishing the inspections and tests specified herein.

4.1.2 Previous Approval - Acceptance or approval of material during course of manufacture shall in no case be construed as a guaranty of the acceptance of the finished product.

4.1.3 Supervision of Tests - When inspection is conducted at the Contractor's plant, all inspection and testing shall be under the supervision of a Government Inspector.

4.1.4 Record of Tests - The Contractor shall maintain a record available to the Inspector, showing the results of all Inspection Tests.

4.1.5 Laboratory Facilities - Contractors not having laboratory facilities satisfactory to the Inspector shall engage the services of a commercial testing laboratory acceptable to the Inspector.

4.1.6 Pre-Submission Testing - No item, part, or complete equipment shall be submitted to the Government Inspector by the Contractor until it has been previously tested and inspected by the Contractor and found to comply to the best of his knowledge and belief with all applicable requirements. With the consent of the Contractor and at the discretion of the Procuring Agency, this prior test and inspection may be participated in or witnessed by the Government Inspector with the object of eliminating the necessity of repeating such test and inspection after the equipment has been formally submitted to the Government Inspector.

4.1.7 Rejection and Retests - The equipment which has been rejected may be reworked or have parts replaced to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the Inspector. Units rejected after retest shall not be resubmitted without the specific approval of the Procuring Agency.

#### 4.2 Inspection

4.2.1 Examination of Product - Each assembly, sub-assembly, and part shall be examined as the Inspector may deem necessary to determine conformance with this specification and the applicable drawings with respect to material, dimensions, instructions, and workmanship.

#### 4.3 Test Procedures

4.3.1 Classification - Tests shall be classified as follows:

- a. Type Tests
- b. Inspection Tests

4.3.2 Type Tests - Type tests shall be performed on one (1) of the first twenty (20) production units and on one (1) of each subsequent group of one hundred (100) production units or parts thereof, for each manufacturer supplying equipment in accordance with this specification.

4.3.2.1 Type test samples shall be selected at random from production units that have passed all inspection tests and shall have inspection tests repeated under environmental conditions specified in 3.8 of this specification.

4.3.3 Inspection Tests - Inspection tests shall be made on all production assemblies submitted for acceptance under the Contract, to determine conformance with the requirements of this specification and to determine that the assemblies are equivalent in performance and construction to the approved samples. All production lots as defined in 4.3.2 will be accepted contingent upon type tests approval.

4.3.3.1 Test Equipment - The following listed test equipment will be required to perform tests specified in 4.3.3.2. See Figure 3 and Figure 4 for typical arrangements.

4.3.3.1.1 Stop watch.

4.3.3.1.2 Counter showing tens, units, and tenths of revolutions arranged to engage the output shaft of the servo unit.

4.3.3.1.3 Test stand, on which the unit can be mounted so that its output shaft is horizontal, with provisions for driving the input shaft at a speed of  $1250 \pm 25$  rpm.

4.3.3.1.4 Current generator to supply the coil currents for cycling, such as that shown in Figure 2. The direct current milliammeter measuring current difference shall be accurate within 2%.

4.3.3.1.5 Facilities for measuring backlash at the output shaft of the servo unit, such as shown in Figure 1.

4.3.3.1.6 Synchro Alignment Set, TS-714/U.

4.3.3.2 Tests - All assemblies shall be subjected to tests specified in 4.3.3.2.1 through 4.3.3.2.3 at normal room conditions. Definitions as specified in 3.7.1 are applicable in this section.

4.3.3.2.1 Synchro Alignment Test - Conduct test to insure compliance with 3.7.2. See NAVORD OD 7672 for complete synchro alignment procedure.

4.3.3.2.2 Backlash - Measure the backlash at the output coupling, BuOrd drawing 837015, at four (4) positions of the coupling, approximately 90° apart, and then average. The backlash to be measured is the total play between the output coupling and the clutch disc gears, BuOrd drawing 836963. Care shall be taken to apply only enough force to take up the backlash. See Figure 1 for a typical method of measurement. The unit shall comply with requirement 3.7.3.

4.3.3.2.3 Output Torque Test - Apply 8.0 ma DC positive current difference to the Vertical Stabilization Antenna Drive and measure the output torque. The unit shall comply with 3.7.4.

CAUTION: In no case shall more than a 7 inch-pound torque load be applied to the output shaft of the Vertical Stabilization Antenna Drive.

4.3.3.2.4 Clutch Characteristics - While driving the input coupling at  $1250 \pm 25$  rpm, the clutch shall be cycled five (5) times as directed in 3.7.1.3, and during a sixth cycle a characteristic shall be taken. This consists of measuring the output speed with counter and stop watch over a period of at least 60 seconds for various values of current difference. Vary current difference until maximum speed of output coupling, BuOrd drawing 837015, is reached. Note value of current difference when output shaft just starts rotating and also at each 0.4 milliamperes increment until maximum speed is reached. It is not necessary to measure speeds when the speed is decreasing except to note the speed at zero current difference. The measurements obtained shall be plotted. See Figure 5 for typical curve. It is important that the direction in which the current difference is going be reversed only at the 8.0-ma d-c points to eliminate uncertainties due

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to hysteresis. Plotted curves shall be checked for conformance with the requirements specified in 3.7.5 of this specification.

4.4 Clutch Adjustments - Should the clutch characteristic fail to meet the requirements, perform operations described in 4.4.1 through 4.4.5.

4.4.1 Change the thickness of the shim, BuOrd drawing 838464-1, to 17 at Coils A and/or B.

4.4.2 Check the spring properties of springs, BuOrd drawing 836960.

4.4.3 Check the core sub-assemblies (Coils A and B) as specified on BuOrd drawing 776402.

4.4.4 Clean the cork clutches as specified on BuOrd drawing 790365.

4.4.5 Check the thickness of the shims, BuOrd drawing 836955.

4.5 Upon completion of all tests, position the output coupling as required by 3.7.2.

## 5. PREPARATION FOR DELIVERY

5.1 Packaging and Packing - Packaging and packing shall be in accordance with MIL-P-116, Method II, paragraph 3.5.7.2.2 or 3.5.7.2.4, as applicable. Such items shall be packaged by either of the above methods as directed by the Procuring Agency. Further, metal containers shall be surrounded by suitable cushioning material and packed in a wooden case as directed by the Procuring Agency.

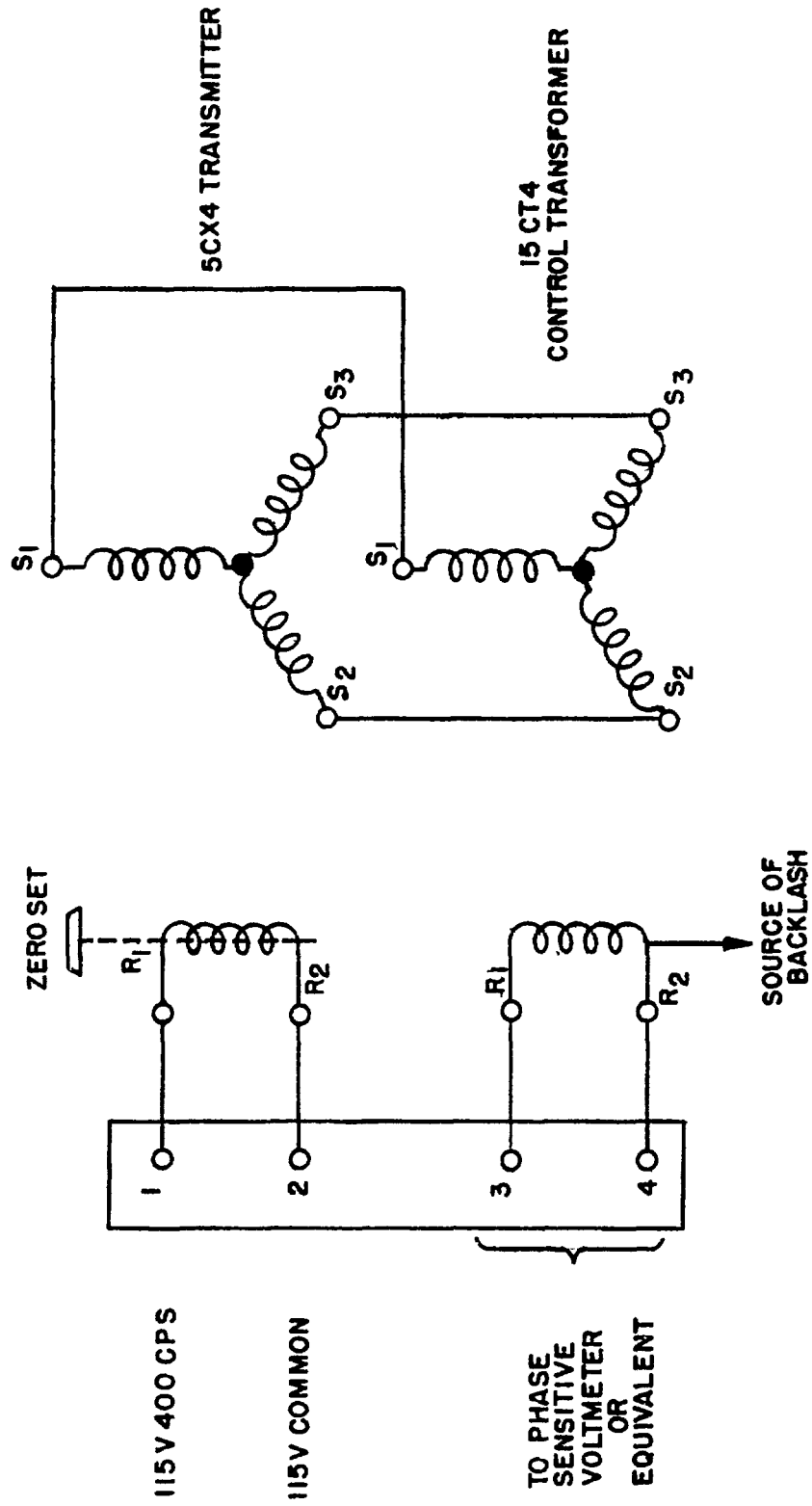


Figure 1. Circuit For Measurement of Backlash

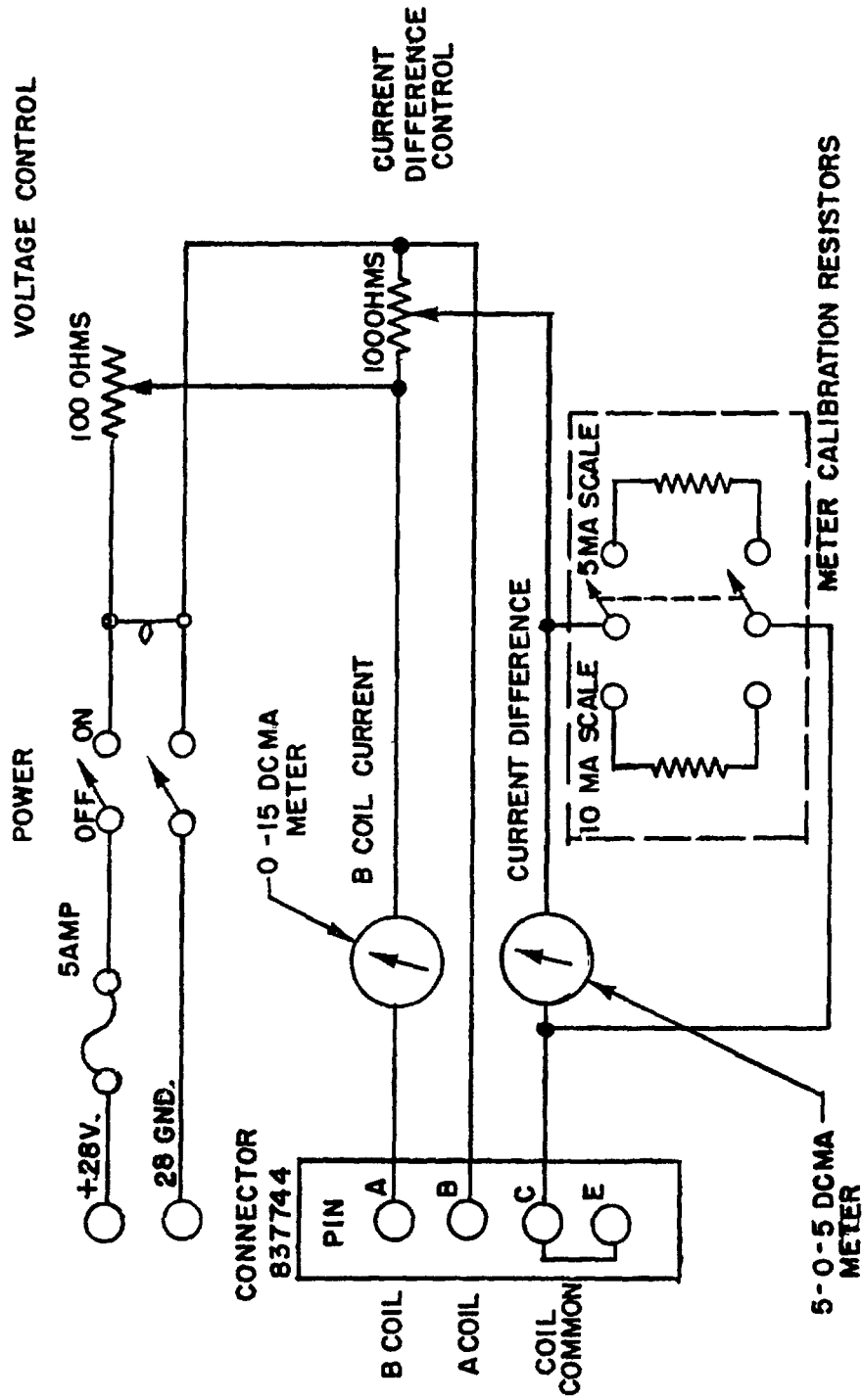


Figure 2. Current Generator

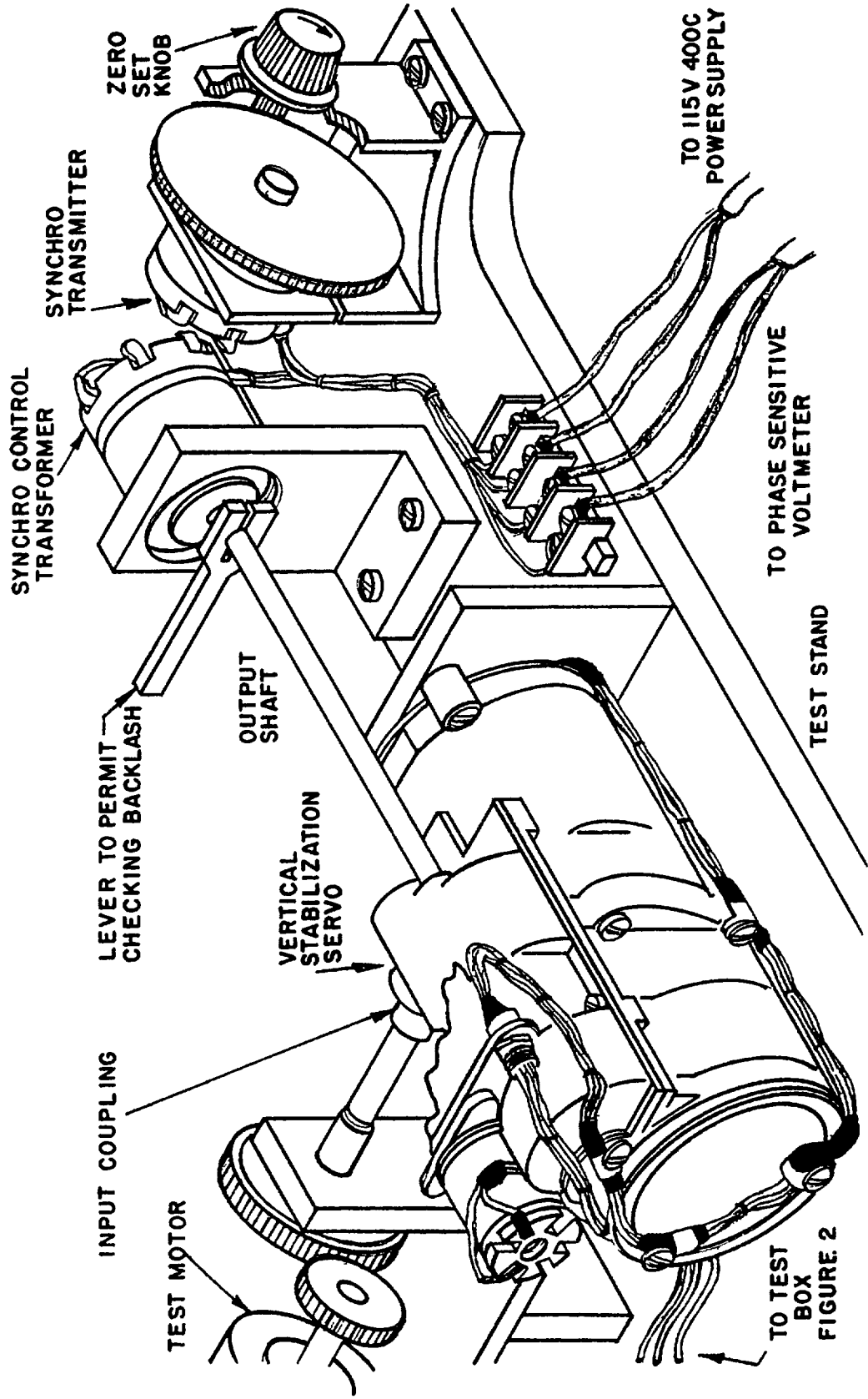


Figure 3. Pictorial Schematic of Vertical Stabilization Servo Backlash Test

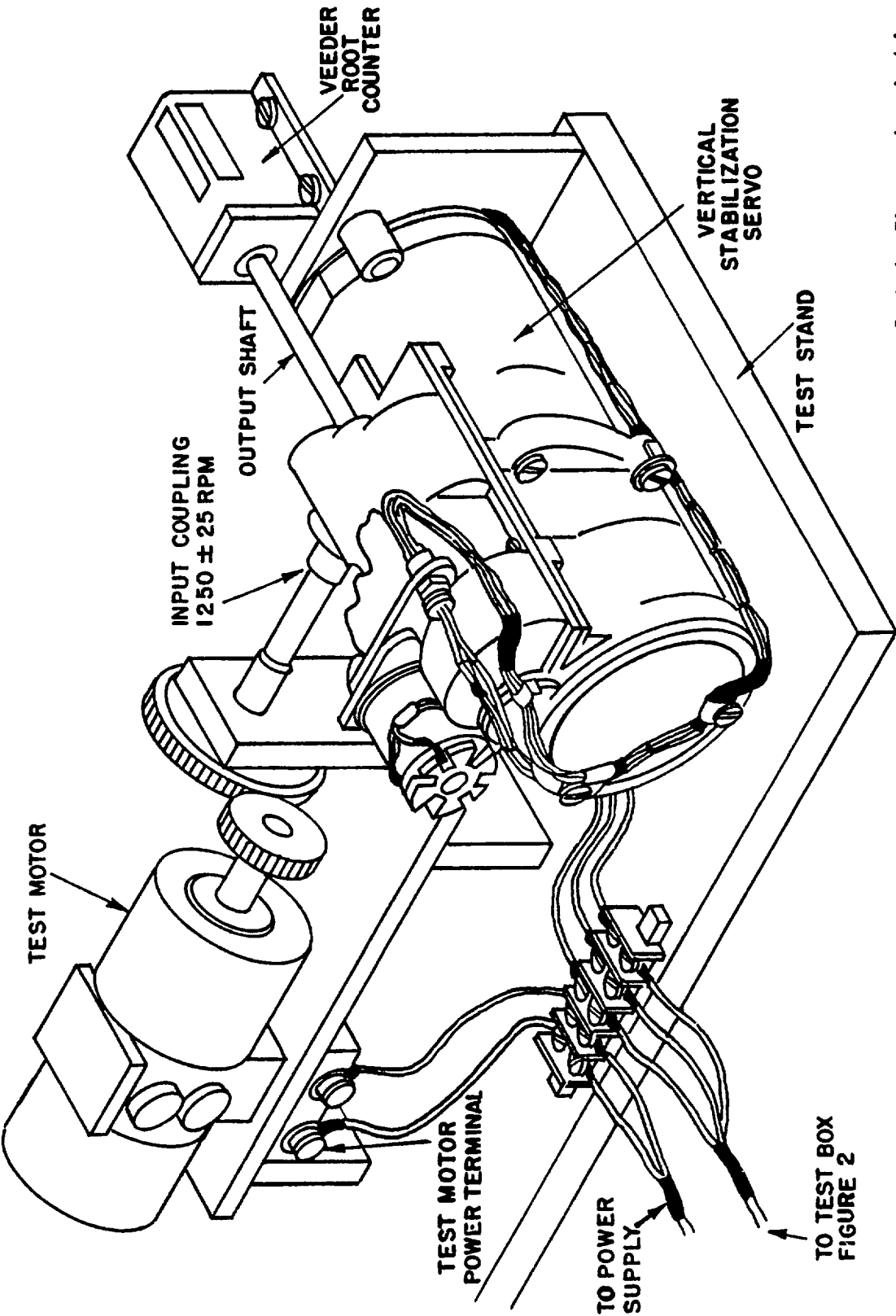


Figure 4. Pictorial Schematic of Vertical Stabilization Clutch Characteristic Test

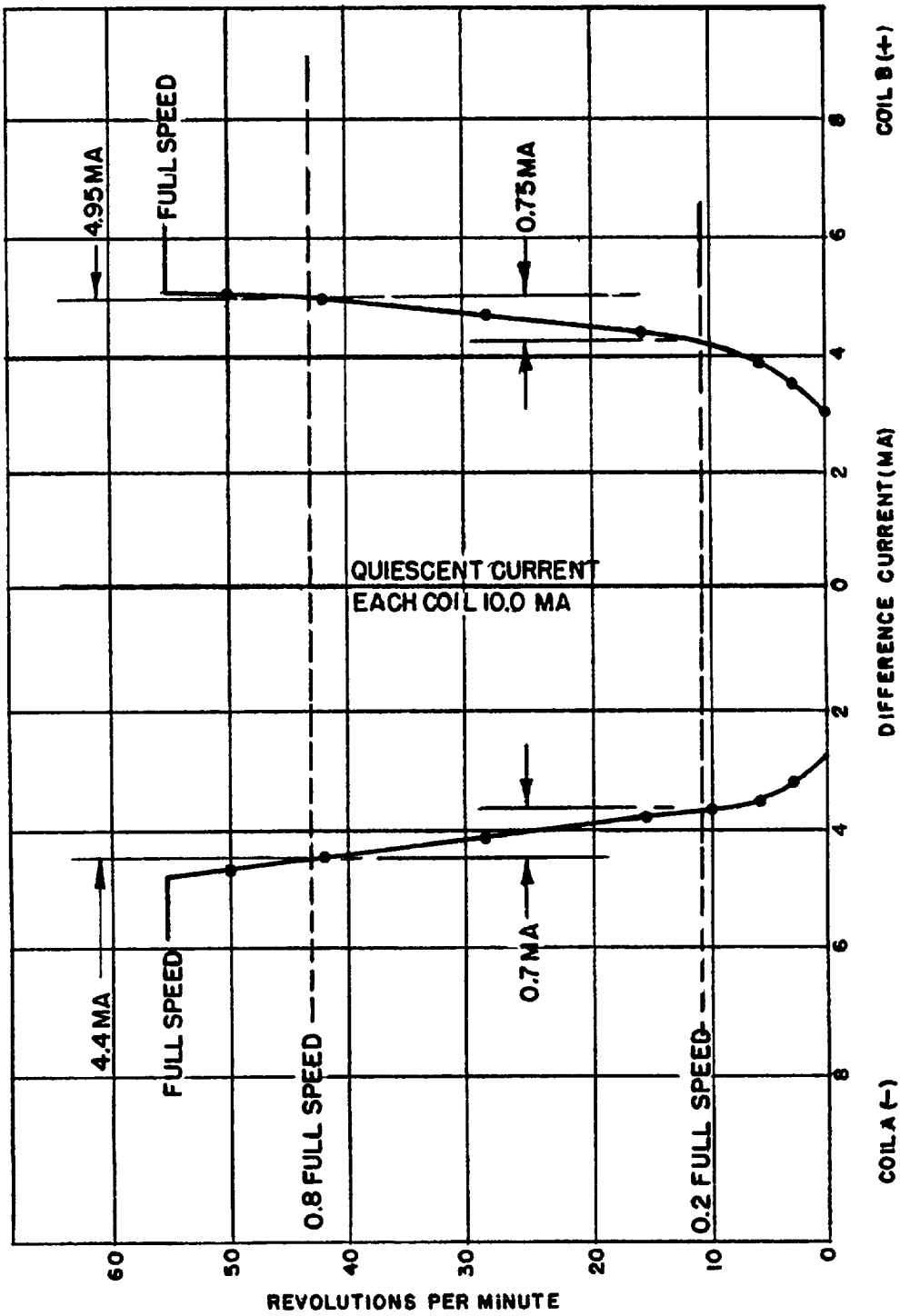


Figure 5. Typical Clutch Characteristics Curve

5.1.1 Labeling and Marking - Labeling and marking shall be in accordance with MIL-STD-129, Military Standard Marking of Shipments, except as may be modified by the Procuring Agency.

## 6. NOTES

6.1 Notice - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.